CLAIMS

What is claimed is:

1. A electromagnetic induction detection apparatus comprising:

a transmitter element that emits a primary magnetic field which induces a secondary magnetic field in an external body;

a receiver element that receives the secondary magnetic field; and

a magnetic shield disposed around said receiver element that limits the lateral footprint diameter of the secondary magnetic field observed by said receiver element.

2. The electromagnetic induction detection apparatus of claim 1, wherein said magnetic shield is constructed of magnetic field absorbant or magnetic field reflective material.

3. The electromagnetic induction detection apparatus of claim 1, wherein said magnetic shield is cone-shaped, said receiver element concentrically disposed at the narrow end of said cone-shaped magnetic shield.

4. The electromagnetic induction detection apparatus of claim 1, wherein said magnetic shield comprises an outwardly angled shield wall.

5. The electromagnetic induction detection apparatus of claim 3, wherein said outwardly angled shield wall is sloped to form an angle between the shield wall and the footprint surface within an open end of the magnetic shield from 28° to 90°.

6. The electromagnetic induction detection apparatus of claim 1, wherein said transmitter element is an inductive coil.

7. The electromagnetic induction detection apparatus of claim 1, wherein said receiver element is an inductive coil.

8. The electromagnetic induction detection apparatus of claim 1, wherein said transmitter element, said receiver element are disposed in a horizontal loop-loop configuration on a substantially rigid, non-conductive support platform.

9. The electromagnetic induction detection apparatus of claim 8, wherein said receiver element is mounted in a coplanar, displaced manner with respect to said transmitter element on said support platform such that said receiver element is substantially shielded from the primary magnetic field emitted from said transmitter element.

10. The electromagnetic induction detection apparatus of claim 8, wherein said transmitter element, said receiver element and said non-conductive support platform form a discrete electromagnetic induction detection apparatus that may be flown in a suspended manner below an aircraft.

11. The electromagnetic induction detection apparatus of claim 10, further comprising an aircraft that transportably positions said electromagnetic induction detection apparatus.

12. A method for obtaining multi-layer field conductivity profiles from received electromagnetic induction field response data having multiple frequency response components, said method comprising:

receiving a set of parameter estimates in accordance with the number of frequency response components in the received electromagnetic induction field response data;

applying the received parameter estimates as a forward model solution;

determining the Jacobian of the residual function at a point using a finite difference approximation to obtain a model response; and

inverting the model response into model parameters;

applying trust region processing to compare a predicted model response to an actual response by minimizing the sum of the Jacobian and the least squares residual function; and

refining a next set of parameter estimates using discrepancies between the predicted model response and the actual response.

13. The method of claim 12, wherein said processing the forward model subroutine comprises applying a Frischknecht Integral using a weighted zeroes Bessel function to compute frequency-domain responses for a horizontal loop-loop configuration.

14. The method of claim 12, further comprising applying the next set of parameter estimates as a next forward model solution.